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BIOLOGICAL EVALUATION OF A MOUNTAIN PINE BEETLE INFESTATION ON THE SAWTOOTH NATIONAL RECREATION AREA, IDAHO - 1987

By

Forest Pest Management

ABSTRACT

Five drainages within the Sawtooth Valley were evaluated for potential lodgepole pine losses to the mountain pine beetle. Current tree mortality levels and adjacent stand conditions indicate considerable potential for the outbreak to continue to enlarge. Tree mortality and future outbreak trends are discussed along with management alternatives and recommendations.

INTRODUCTION

Mountain pine beetle (MPB), (Dendroctonus ponderosae Hopkins, populations have been increasing since 1983 in stands of lodgepole pine (LPP), Pinus contorta var. latifolia Engelmann, within the scenic Sawtooth Valley on the Sawtooth National Recreation Area, Sawtooth National Forest, Idaho. Significant activity is currently occurring in the Alturas Lake Creek, Champion Creek, Pole Creek, Lost Creek, and Taylor Creek drainages (Figure 1).

Aerial detection surveys indicate tree mortality has increased from around 100 trees, limited to the Alturas Lake Creek area, in 1983, to almost 2,000 throughout the Sawtooth Valley in 1986. A ground evaluation survey was conducted after beetle flight in 1987 to determine population trends and predict possible future impacts on surrounding LPP stands. The purpose of this report is to (1) describe current situations, (2) project insect population trends and damage potential, and (3) provide recommendations for minimizing future LPP losses to MPB.

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EXPERIMENT STATION

BIOLOGICAL INFORMATION

Mountain pine beetle typically passes through a 1-year life cycle, i.e., larvae, pupae, and adult. All stages are spent under the bark of infested trees, except when adults emerge and fly to green trees in midsummer, usually mid-July to mid-September. Following attack, adults construct egg galleries and introduce blue stain fungal spores into the sapwood. The beetles overwinter as larvae and complete their development the following spring and early summer (Cole & Amman 1980).

In the endemic state, the beetle serves as a natural thinning agent, killing diseased or otherwise stressed trees (Tkacz & Schmitz 1986). As more trees greater than 7 inches in diameter become stressed and susceptible to attack, MPB population numbers and subsequent tree mortality begin to accelerate. As the MPB reaches the epidemic stage, the number of beetles attacking a single healthy tree can easily overcome the tree's natural defenses.

Outbreak infestations are cyclic, occurring every 25 to 40 years and lasting 9 to 15 years. Typically an infestation will persist until 70 to 80 percent of the stems more than 5 inches in diameter have been killed. The most important factors affecting survival of the beetle brood and expansion of the population to epidemic levels are climate, size and age of trees, phloem thickness, stand structure, and stand density.

This insect does best in the largest LPP with the thickest phloem. These larger trees provide the best food for the developing larvae and maintain higher moisture levels throughout beetle development. This preference for larger trees makes stand structure an important criteria in beetle population dynamics. The average age of trees in stands where significant outbreaks begin to occur is about 80 years. The potential for LPP losses increases as the proportion of trees 8 inches in diameter or larger increases in a stand (Amman & Cole 1983).

METHODS

Based on aerially detected mountain pine beetle activity, the infested portion of the Sawtooth Valley was divided into five evaluation areas (Figure 1). During late summer of 1987, 73 permanent strip plots (1/2 chain x 10 chains) were established: 27 in the Alturas Lake Creek area, 8 in the Champion Creek area, 16 in the Pole Creek area, 8 in the Lost Creek area, and 14 in the Taylor Creek area. In each plot, the diameter and year of attack (1987, 1986, or 1985 and prior) of all infested or dead LPP, over 5 inches DBH, were recorded.

Uninfested tree information for each strip plot was obtained from a randomly placed variable plot (40 basal area factor) for trees over 5 inches DBH and from a 1/300-acre fixed plot for trees less than 5 inches DBH. Data was analyzed using the INDIDS computer program (Bousfield 1980, Bousfield et al. 1985).

Over the survey area the number of LPP killed by the MPB has tripled from 1986 to 1987 with an average of 6.7 trees/acre killed in 1986 and 18.7 trees/acre killed in 1987 (Table 1). This increased activity indicates the start of an epidemic. A two-fold increase occurred at Champion Creek; whereas, a five-fold increase occurred at Pole Creek. However, because a number of MPB killed trees had been removed by woodcutters prior to this study, total tree mortality could not be determined. This increase in activity may be due to the extended hot, dry weather in 1986 and 1987 that likely created a moisture stress on the trees and reduced their ability to repel the MPB.

In 1987, over 45 percent of the activity was concentrated in the 5- to 8.9-inch diameter class trees. These trees are more numerous than larger diameter trees (Table 1). However, as stated earlier, many large-diameter trees infested prior to 1987 had been removed for fuel wood prior to the survey, so estimates of total tree mortality are low.

An average of about 21 percent of all LPP over 5 inches in diameter (susceptible to attack) in the infested areas have been killed by MPB since 1983. More than half of this occurred during 1987. Data indicate that 32 percent of the 12-inch and larger trees, 39 percent of the 9- to 11.9-inch trees, and 8 percent of the 5- to 8.9-inch trees were killed in 1987. These numbers confirm that the insect concentrates activity in the larger diameter, older trees.

The uninfested tree counts provide another perspective (Table 1). The infested areas are stocked on the average with over 1,400 trees/acre; about half LPP and half non-host Douglas-fir, subalpine fir, aspen, and spruce. In the small diameter classes (less than 5 inches DBH), LPP is the most abundant species. As MPB activity continues to reduce the number of larger diameter LPP (over 5 inches DBH), non-host trees are beginning to outnumber them. Such is the case in the Champion Creek and Taylor Creek areas.

Although the data collected in these five drainages can be generally extrapolated to the entire Sawtooth Valley with reasonable certainty, it is difficult to accurately predict the magnitude of the potential MPB epidemic because factors such as climate can drastically affect beetle populations. However, without intervention, the current infestation is likely to extend into adjacent or nearby green LPP stands of similar condition and structure. Large numbers of dead trees may create forest management problems such as increasing the potential for catastrophic fires and, in developed sites, significantly increasing major hazards to users.

MANAGEMENT ALTERNATIVES

Application of environmentally acceptable, economically sound management strategies require a precise determination of site-specific land and resource management objectives. Alternative strategies for reducing MPB impacts are summarized below. Resource management objectives will dictate which management alternative(s) should be used to obtain maximum impact reduction compatible with economic and environmental considerations.

No Action - This alternative would allow the infestation to continue until it collapses naturally. This approach would not be effective in preventing additional tree mortality. There would be no direct costs associated with selection of this alternative. Stand age, structure, and composition would be altered, and forest management objectives could be adversely affected over a long period of time.

Direct Suppression - This alternative involves individual tree treatment. It may be accomplished by removing infested trees, treating them with a chemical insecticide, or by peeling and burning them. Individual tree treatment is expensive and often effective only in small infestations. Chemically treated merchantable trees could be salvaged at a later date.

Patch Cuts - Patch cuts of 10-20 acres in size will create age/size mosaics from extensive even-aged LPP stands. Large drainages can be organized for long-term harvesting patterns to create less favorable conditions for MPB. When dwarf mistletoe (DM) is present, clearings should be at least 20 acres in size to minimize spread by DM from the perimeters.

Sanitation Logging - In this alternative, susceptible green trees would be removed on a selective basis. Trees would be removed, changing the green stand structure by reducing the stand density index (SDI), thus increasing resin flow, the tree's defensive mechanism. This alternative would not be effective by itself in an already infested stand; however, sanitation logging could be used to reduce susceptibility of adjacent, uninfested stands.

Salvage Logging - Both currently infested trees and dead trees would be removed. This alternative would utilize the timber resource as well as suppress the infestations. This type of logging would not change stand conditions currently contributing to the outbreak.

Sanitation/Salvage Logging - This alternative combines the removal of dead and infested trees and the susceptible uninfested trees in a stand. This would allow utilization of the timber resource and reduce the susceptibility of the stand by changing the stand structure.

RECOMMENDATIONS

An integrated strategy utilizing aspects of all available mitigation measures is recommended, depending on the site-specific short- and long-term management objectives.

The species composition, structure, and condition of these and adjacent stands will continue to contribute to tree mortality until the epidemic recedes. Changed climatic conditions and/or a substantial reduction in larger diameter LPP will help trigger a reduction in MPB populations.

Prompt action in valuable developed sites near MPB infestations will be required to prevent unacceptable losses of LPP. Chemical treatment with carbaryl (Sevin SLR) prior to beetle flight affords excellent protection for

2 years. It is recommended that all high-value LPP adjacent to stands with significant MPB populations be chemically treated prior to June 1, 1988. This treatment does not alter the susceptibility of these trees, and silvicultural treatments must be carried out to provide long-term protection from MPB (Amman et al. 1977, Cole & McGregor 1985).

In other than developed sites, application of patch cutting, sanitation/salvage logging, and do nothing alternatives are recommended as site-specific conditions/concerns and product marketability allow. The cultural alternatives, while utilizing some of the timber resource, allow integrating strategies for minimizing impacts of other major existing and potential pests.

Before specific lodgepole pine/mountain pine beetle management action plans are finalized, it is recommended that Forest Pest Management be contacted for additional information and assistance in applying any of the tactics selected.

ACKNOWLEDGEMENTS

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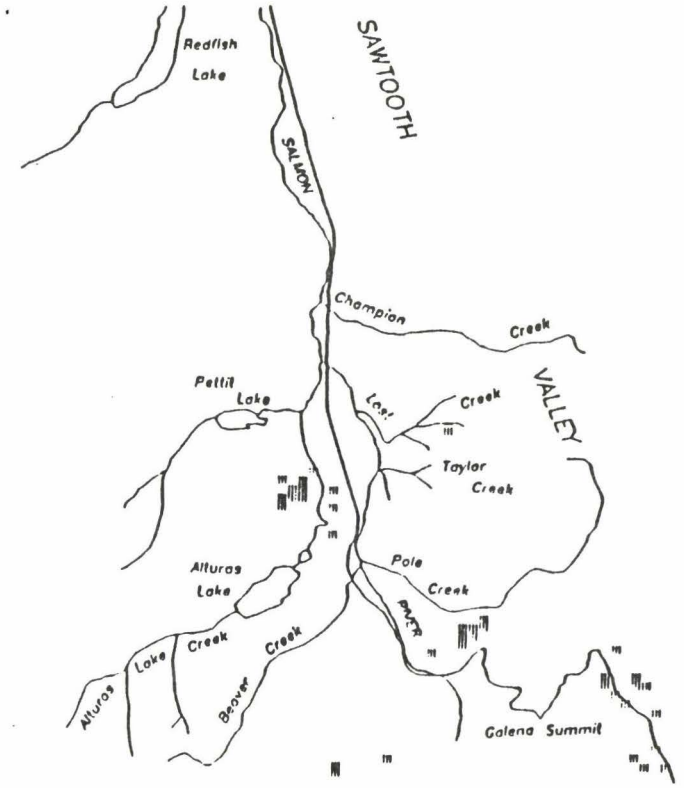
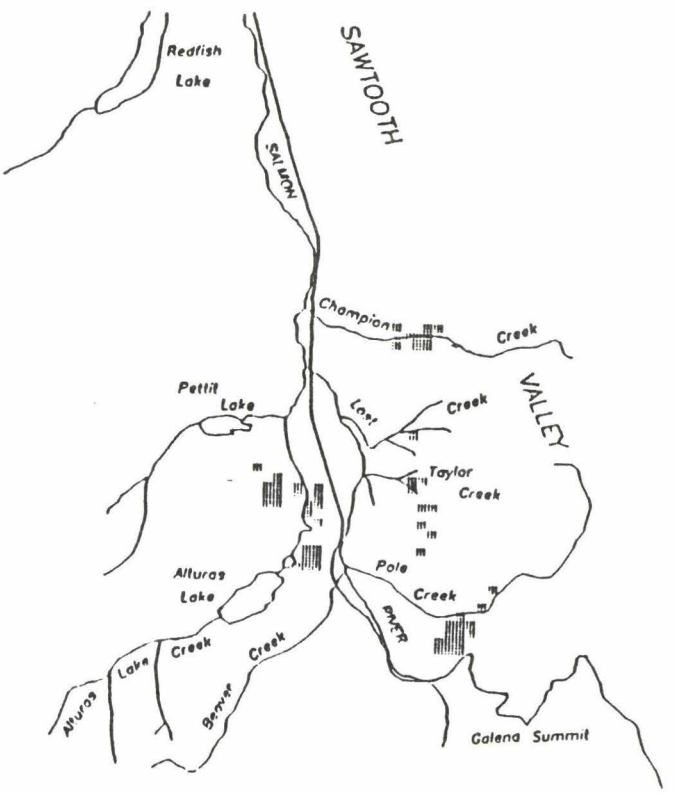


1984



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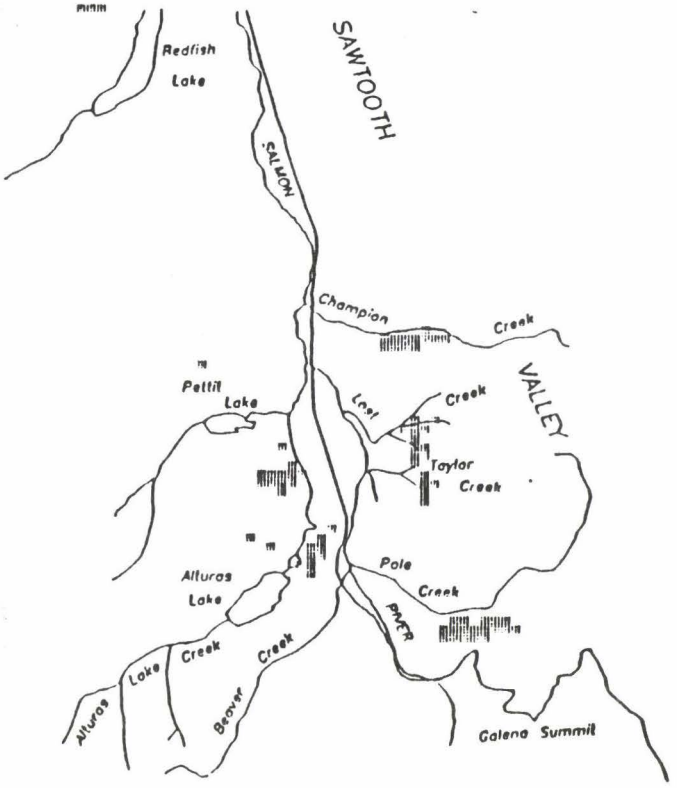

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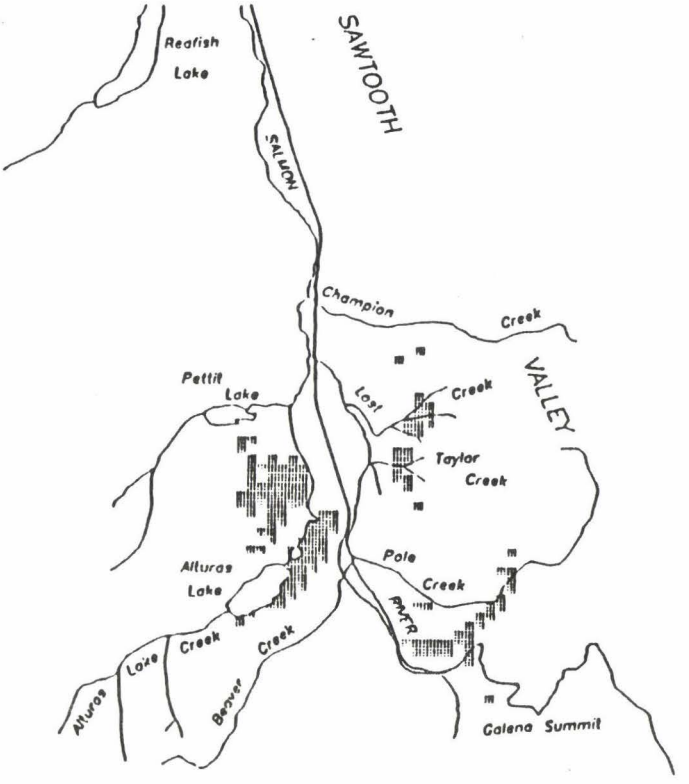

1987

Figure 1. Mountain pine beetle infestations, Sawtooth Valley, Sawtooth National Recreation Area, Sawtooth National Forest, Idaho - 1984 - 1987 according to aerial detection surveys. ▦ = dead lodgepole pines

Table 1. Results of the 1987 Sawtooth Valley mountain pine beetle survey.

Area	Year	No. mountain pine beetle killed lodgepole pines/acre by diameter				No. live lodgepole pine/acre by diameter[1]					No. live non-host trees/acre by diameter[1]				
		5 - 8.9"	9 - 11.9"	12"+	Total	0 - 4.9"	5 - 8.9"	9 - 11.9"	12"+	Total	0 - 4.9"	5 - 8.9"	9 - 11.9"	12"+	Total
Alturas Lake Creek	1987	4.9	6.2	3.4	14.5	709.0	218.3	35.8	11.0	974.1	804.6	222.5	21.2	17.0	1065.3
	1986	2.3	1.6	1.6	5.5										
	1983-1985	0.4	0.2	0.3	0.9										
Champion Creek	1987	19.7	8.3	2.6	30.6	675.0	29.5	7.4	0	711.9	412.5	30.5	17.3	3.3	463.6
	1986	9.1	3.1	0.3	12.5										
	1983-1985	5.4	2.0	0	7.4										
Lost Creek	1987	10.0	13.2	4.8	28.0	514.3	93.7	10.1	6.4	624.5	171.5	0	18.5	41.1	231.1
	1986	2.8	4.0	2.4	9.2										
	1983-1985	5.6	1.2	0	6.8										
Pole Creek	1987	3.7	2.6	1.1	7.4	623.1	98.8	0	2.8	724.7	1615.4	36.2	18.9	23.5	1694.0
	1986	0.9	0.6	0	1.5										
	1983-1985	4.3	4.7	0.3	9.3										
Taylor Creek	1987	5.3	4.3	3.3	12.9	420.0	64.7	0	12.4	497.1	30.0	55.8	19.4	15.5	120.7
	1986	1.3	3.0	0.3	4.6										
	1983-1985	6.0	4.8	4.5	15.3										
Average of all areas	1987	8.7	6.9	3.0	18.7	588.3	101.0	10.7	6.5	706.5	606.8	69.0	19.1	20.1	714.9
	1986	3.3	2.5	0.9	6.7										
	1983-985	4.3	2.6	1.0	7.9										

[1] trees not killed by beetles but may be affected by other insects and diseases

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